ENERGY ENGINEERING, B.S.

Begin Campus: Any Penn State Campus
End Campus: University Park

Program Description
The undergraduate program in energy engineering is designed to reflect the growing impact and demand for energy in society and to equip students with the knowledge necessary to achieve the following career and professional goals to become:

- Valuable contributors in addressing society’s energy needs and demands
- Successful leaders in advancing the technology and management of energy
- Innovators and entrepreneurs in the energy sector
- Educators, practicing engineers, and national leaders on energy and associated environmental, health and safety, and policy and economics issues

The program integrates skill sets in the physical sciences (chemistry, engineering, mathematics, and physics) and social sciences (economics, policy, and management) to ensure successful career opportunities and growth within energy-related industries, government agencies, and academia.

The courses are structured to enable students to understand engineering fundamentals and apply the knowledge to solve problems in the production, processing, storage, distribution, and utilization of energy using multiple techniques as synthesis, analysis, design, and case studies. Inquiry-based teaching methods and lab experiences are emphasized. The faculty research and scholarly activities are integrated into the curriculum. The program is designed to train students to be lifelong learners, problem solvers, and energy industry leaders. The educational opportunities are sufficiently flexible, broad, and diverse to enable students to tailor their educational experience to particular interests, background, and expected role in society. Flexibility in the curriculum allows other students in energy-related programs such as agricultural and biological, chemical, civil, electrical, environmental, mechanical, mining, nuclear, and petroleum engineering, materials science and engineering, industrial health and safety, and energy business and finance to have dual or concurrent degrees, minors, or options (e.g., energy and fuels engineering option in chemical engineering).

What is Energy Engineering?
Energy engineers are equipped with required engineering knowledge and skills needed to solve problems in the production, processing, storage, distribution, and utilization of energy. Energy processes include natural resources, such as the extraction of oil and gas, as well as from renewable or sustainable sources of energy, including biofuels, hydro, wind, and solar power.

You Might Like This Program If...

- You aspire to be a lifelong learner, problem-solver, and leader in the energy industry.
- You excel at math, science, and engineering and seek a broad overview of energy fields.
- You're interested in a well-rounded education on all facets of the energy market, including renewable energy.

Entrance to Major
In addition to the minimum grade point average (GPA) requirements described in the University Policies, the Energy Engineering entrance-to-major requirement must also be completed with a minimum grade of C: MATH 140.

Degree Requirements
For the Bachelor of Science degree in Energy Engineering, a minimum of 131 credits is required:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>116</td>
</tr>
</tbody>
</table>

30 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 3 credits of GH courses; 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 9 credits of GWS courses.

General Education
Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required.)

- Quantification (GQ): 6 credits
- Writing and Speaking (GWS): 9 credits

Knowledge Domains

- Arts (GA): 6 credits
- Health and Wellness (GHW): 3 credits
- Humanities (GH): 6 credits
- Social and Behavioral Sciences (GS): 6 credits
- Natural Sciences (GN): 9 credits

Integrative Studies (may also complete a Knowledge Domain requirement)

- Inter-Domain or Approved Linked Courses: 6 credits

University Degree Requirements

First Year Engagement
All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.
Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

### Cultures Requirement
6 credits are required and may satisfy other requirements
- United States Cultures: 3 credits
- International Cultures: 3 credits

### Writing Across the Curriculum
3 credits required from the college of graduation and likely prescribed as part of major requirements.

### Total Minimum Credits
A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

### Quality of Work
Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

### Limitations on Source and Time for Credit Acquisition
The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80). For more information, check the Suggested Academic Plan for your intended program.

### Requirements for the Major
To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

#### Prescribed Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 110</td>
<td>Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111</td>
<td>Experimental Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 112</td>
<td>Chemical Principles II</td>
<td>3</td>
</tr>
<tr>
<td>EE 211</td>
<td>Electrical Circuits and Power Distribution</td>
<td>3</td>
</tr>
<tr>
<td>ECEE 12</td>
<td>Energy Science and Engineering Lectures</td>
<td>1</td>
</tr>
<tr>
<td>EMSC 100S</td>
<td>Earth and Mineral Sciences First-Year Seminar</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 202C</td>
<td>Effective Writing: Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>FSC 431</td>
<td>The Chemistry of Fuels</td>
<td>3</td>
</tr>
<tr>
<td>FSC 432</td>
<td>Petroleum Processing</td>
<td>3</td>
</tr>
<tr>
<td>MATH 141</td>
<td>Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus of Several Variables</td>
<td>2</td>
</tr>
<tr>
<td>MATH 251</td>
<td>Ordinary and Partial Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>MATSE 201</td>
<td>Introduction to Materials Science</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 103</td>
<td>Ethics</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Prescribed Courses: Require a grade of C or better

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHYS 211</td>
<td>General Physics: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 212</td>
<td>General Physics: Electricity and Magnetism</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Additional Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 202</td>
<td>Fundamentals of Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 210</td>
<td>Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>ECEE 460</td>
<td>Geo-resource Evaluation and Investment Analysis</td>
<td>3</td>
</tr>
<tr>
<td>or IE 302</td>
<td>Engineering Economy</td>
<td></td>
</tr>
<tr>
<td>ENGL 15</td>
<td>Rhetoric and Composition</td>
<td>3</td>
</tr>
<tr>
<td>or ENGL 30</td>
<td>Honors Freshman Composition</td>
<td></td>
</tr>
</tbody>
</table>

Select 3 credits of the following:

- EBF 200 Introduction to Energy and Earth Sciences Economics
- ECON 14 Principles of Economics
- ECON 102 Introductory Microeconomic Analysis and Policy

Select 3 credits of the following:

- CMPSC 200 Programming for Engineers with MATLAB
- CMPSC 201 Programming for Engineers with C++
- CMPSC 202

#### Additional Courses: Require a grade of C or better

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESEE 494</td>
<td>Research Project</td>
<td>2</td>
</tr>
<tr>
<td>or ESEE 295/395/495</td>
<td>Internship</td>
<td></td>
</tr>
</tbody>
</table>

#### Supporting Courses and Related Areas

Select 3 credits of ESEE electives from an approved list in consultation with an adviser.

Select 6 credits of professional courses from an approved list in consultation with an adviser.

Select 6 credits of technical electives from a broad list of energy-related courses across colleges at Penn State.

1 The following substitutions are allowed for students attending campuses where the indicated course is not offered: CAS 100 can be substituted for EMSC 100S.

2 Other substitutions outside the approved list must be approved by petition.

3 A list of suggested courses from energy-related departments at Penn State is provided. Students may apply 6 credits of ROTC to some of the elective choices.
Integrated B.S. in Energy Engineering (ENENG) and M.S. in Energy and Mineral Engineering (EME)

The integrated undergraduate-graduate (IUG) program between the Energy Engineering undergraduate program and the Energy and Mineral Engineering graduate program enables academically superior and research-focused ENENG undergraduate students to also obtain an M.S. degree in Energy and Mineral Engineering in five years of study. Students should refer to the Energy and Mineral Engineering graduate program in the Graduate Program Bulletin (http://bulletins.psu.edu/graduate/programs/majors/energy-mineral-engineering) for the IUG admission and degree requirements.

Course Substitutions for the Integrated B.S. in Energy Engineering (ENENG) and M.S. in Energy and Mineral Engineering (EME)

As many as 12 of the credits required for the master's degree may be applied to both the B.S. and M.S. degrees. A minimum of 6 credits counted for both the B.S. and M.S. degrees must be at the 500-level. Thesis and culminating/capstone experience credits may not be double counted. The undergraduate degree program officer will determine the specific undergraduate required courses for which the 500-level courses may be used to substitute to meet institutional and accreditation requirements.

Program Educational Objectives

Our graduates will be:

1. Employed in the public or private sectors in the areas of energy science, energy engineering or energy business management, or pursuing an advanced degree.
2. Contributing to development of solutions to society’s current energy needs by integrating key science and engineering principles while being adaptable to changing organizational and societal needs;
3. Engaged in individual projects and multidisciplinary teams designing, evaluating, and recommending methods and strategies for the efficient production, processing and utilization of renewable or non-renewable energy and addressing the associated environmental challenges;
4. Effectively communicating with management, coworkers, customers, clients and others in diverse environments;
5. Engaged in lifelong learning process to maintain professional competency through training, participation in professional activities and leadership.

Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Energy Engineering program is designed to enable students to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. Communicate effectively with a range of audiences
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and-out-of-class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2019-20 academic year. To access previous years’ suggested academic plans, please visit the archive (http://bulletins.psu.edu/undergraduate/archive) to view the appropriate Undergraduate Bulletin edition (Note: the archive only contain suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin).

University Park Campus

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 140 or 140G (GQ)†‡</td>
<td>4</td>
<td>MATH 141 (GQ)†‡</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 110 (GN)†</td>
<td>3</td>
<td>ENGL 15, 30, or ESL 15 (GWS)† ‡</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111 (GN)†</td>
<td>1</td>
<td>CHEM 112 (GN)†</td>
<td>3</td>
</tr>
</tbody>
</table>
Requirements.

Designate courses that satisfy University Writing Across the Curriculum W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Requirements (United States and International Cultures).

US and IL are abbreviations used to designate courses that satisfy University Requirements and General Education.

Notes:

1. Students who begin their studies at non-UP locations and/or join the college after their first year should substitute CAS 100, CAS 100B, or CAS 100C (GWS) for EMSC 100 (GWS). EMSC 100S Earth and Mineral Sciences First year Seminar (3) is a required course only for students who begin their studies at UP in the College of Earth and Mineral Sciences.

2. Course lists for Energy Engineering can be found at the department web site: http://www.eme.psu.edu/energ/courses

3. Students may use up to 6 credits of ROTC as technical electives.

Advising Notes:

To enter the major, students need a minimum 2.00 grade point average, third semester standing, and a C or better grade in MATH 140.

Courses required for the major may be offered fall semester only, spring semester only, or both fall and spring semesters. Consult with your adviser and department to discuss your academic progress and course sequencing.

Commonwealth Campuses

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 140 (GQ)</td>
<td>4</td>
<td>MATH 141 (GQ)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 110 (GN)</td>
<td>3</td>
<td>ECON 102, EBF 200, or ECON 14 (GS)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111 (GN)</td>
<td>1</td>
<td>CHEM 112 (GN)</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 15, 30, or ESL 15 (GWS)</td>
<td>3</td>
<td>PHYS 211 (GN)</td>
<td>3</td>
</tr>
<tr>
<td>General Education Knowledge Domain</td>
<td>3</td>
<td>General Education Knowledge Domain</td>
<td>3</td>
</tr>
</tbody>
</table>

Second Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 212 (GN)</td>
<td>4</td>
<td>ENGL 202C (GWS)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 202 or 210</td>
<td>3</td>
<td>MATH 231</td>
<td>2</td>
</tr>
<tr>
<td>MATH 251</td>
<td>4</td>
<td>CMPSC 200, 201, or 202</td>
<td>3</td>
</tr>
</tbody>
</table>

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of ‘C’ or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

All incoming Schreyer Honors College first-year students at University Park will take ENGL/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

To enter the major, students need a minimum 2.00 grade point average, third semester standing, and a C or better grade in MATH 140.

Courses required for the major may be offered fall semester only, spring semester only, or both fall and spring semesters. Consult with your adviser and department to discuss your academic progress and course sequencing.
**Course Designations**

- **W**: Designates courses that satisfy University Writing Across the Curriculum requirement.
- **GWS, GQ, GHW, GN, GA, GH, GS**: Abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of ‘C’ or better.
- **EGEE**: Courses that satisfy University Writing Across the Curriculum requirement.
- **EME**: Courses that require a grade of ‘C’ or better for the major.
- **EWS, ESN, EWS**: Abbreviations used to designate courses that satisfy University Writing Across the Curriculum requirement.
- **EWS, ESN, EWS**: Abbreviations used to designate Courses that satisfy General Education and degree requirement.
- **FSC**: Credits for students who begin their studies at non-UP locations and/or join the college after their first year should substitute CAS 100, CAS 100A, CAS 100B, or CAS 100C (GWS) EMSC 100S (GWS). EMSC 100S Earth and Mineral Sciences First year Seminar (3) is a required course only for students who begin their studies at UP in the College of Earth and Mineral Sciences.
- **Course lists for Energy Engineering can be found at the department web site: http://www.eme.psu.edu/eneng/courses**
- **Students may use up to 6 credits of ROTC as technical electives.**

**Advising Notes:**

To enter the major, students need a minimum 2.00 grade point average, third semester standing, and a C or better grade in MATH 140.

Courses required for the major may be offered fall semester only, spring semester only, or both fall and spring semesters. Consult with your adviser and department to discuss your academic progress and course sequencing.

**Career Paths**

**Careers**

Our graduates are prepared to become valuable contributors in addressing society’s energy needs and demands.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE ENERGY ENGINEERING PROGRAM (https://www.eme.psu.edu/undergraduate/academics/undergraduate-programs/energy-engineering-major)

**Opportunities for Graduate Studies**

Graduates may be well suited to pursue graduate-level studies. Further study toward an M.S. or Ph.D. can lead to research, university, or management positions.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (https://www.eme.psu.edu/graduate)

**Professional Resources**

- Society of Energy Engineers Penn State Student Chapter (https://www.eme.psu.edu/undergraduate/undergraduate-resources/student-organizations)
- National Electrical Contractors Association Penn State Student Chapter (http://neca-pdj.org/students/penn-state-student-chapter)
- Engineers Without Borders (https://sites.psu.edu/psuewb)

**Accreditation**

The Energy Engineering B.S. program in the John and Willie Leone Family Department of Energy and Mineral Engineering (EME) at Penn State is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org/.

MORE INFORMATION ABOUT ABET ACCREDITATION (http://www.abet.org)

**Contact**

**University Park**

JOHN AND WILLIE LEONE FAMILY DEPARTMENT OF ENERGY AND MINERAL ENGINEERING

113 Hosler Building

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**Course Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS 100, 100A, 100B, or 100C (GWS)</td>
<td>3</td>
<td>General Education Knowledge Domain</td>
</tr>
<tr>
<td>General Education Knowledge Domain</td>
<td>3 PHIL 103 (GH)</td>
<td>3</td>
</tr>
<tr>
<td>General Education Health and Wellness (GHW)</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Total Credits 131</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Students who begin their studies at non-UP locations and/or join the college after their first year should substitute CAS 100, CAS 100A, CAS 100B, or CAS 100C (GWS) EMSC 100S (GWS). EMSC 100S Earth and Mineral Sciences First year Seminar (3) is a required course only for students who begin their studies at UP in the College of Earth and Mineral Sciences.

2. Course lists for Energy Engineering can be found at the department web site: http://www.eme.psu.edu/eneng/courses

3. Students may use up to 6 credits of ROTC as technical electives.

**Notes:**

• Course requires a grade of C or better for the major
† Course requires a grade of C or better for General Education
# Course is an Entrance to Major requirement
‡ Course satisfies General Education and degree requirement

**University Requirements and General Education Notes:**

US and IL are abbreviated used to designate courses that satisfy University Requirements (United States and International Cultures).

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Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.
University Park, PA 16802
814-865-3437
eme@ems.psu.edu

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